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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Anthropogenic radiative forcing time series from pre-industrial times until 2010" *by* R. B. Skeie et al.

Anonymous Referee #1

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In this paper the authors presented the time evolution of radiative forcing from 1750 to 2010 of all the main forcing agents in the atmosphere, with a special focus on short lived chemical species, ozone and aerosols. They used a chemical transport model to calculate the atmospheric composition for time slice simulations and a radiative transfer model to calculate the forcings due to changes in the single components of the atmosphere. The authors supported the model results with a good number of measurements, ozone, aerosol components, and surface radiation.

The presentation and the analysis of the results is clear and insightful. The text is well written and the figures and tables included in the paper are clear and well chosen. I have few minor comments which are listed below.

Page 22550, line 8: The authors do not specify how long are the time slice simulations.

Page 22550, line 10: The authors used the meteorological data of year 2006 for all time slice simulations. I think they should include a sentence motivating this choice and explain if using different meteorological data may partly modify their results. Three years of spin-up seems adequate to reach equilibrium of short lived species, nevertheless I would mention which initial concentrations were assumed for the simulations.

Page 22550, line 16: Which is the assumption behind the 20% reduction of 1850 emissions to obtain the pre-industrial emissions? Check the sentence ".. except agriculture, agriculture- and waste burning and .... ", all sectors are switch off except agriculture, waste burning and domestic?

Page 22551, line 19-22: The authors do not say anything about stratospheric chemistry in the model. Is it explicitly calculated or climatological values are prescribed for O3 and other species?

Page 22551, line 23-28: Could be summarized in 1-2 sentences the main performances of the OsloCTM2 model compared to the other models, in particular for O3 and AOD?

Page 22552, line 19:"an uncertainty range"

Page 22553, line 1-3: sentence long and hard to follow. Consider revising of this sentence. " for changes IN the stratosphere", you may also shorten saying ".. and for changes in tropospheric and stratospheric ozone".

Page 22554, line 17: "All RF values presented ARE relative to ...."

Page 22555, line 10: maybe better "observed" instead of "seen".

Page 22557, line 18: ".. tropospheric O3 with.", is missing some text here?

Page 22558, line 3: "Although ... than in Shindell (2006b), we underestimate the CO in the NH WHERE CO concentrations ... "

Page 22558, line 6-9: The authors compare the year 2000 simulation with observations

averaged over the period 1980-2002. Nevertheless in their study they have simulations for years 1990 and 1980. So I wonder if they did a comparison between model and observations both for the same decades (separated comparisons for 1990 and for 2000).

Page 22558, line 22-23: the authors mention the stratospheric influx as cause of smaller seasonal cycle. This brings back to the methodology (Page 22551) where the authors do not explain how the stratospheric O3 is modeled in the simulations.

Page 22561, line 6-7: there are considerable uncertainties in the parameterization of NOx emissions (e.g. Grewe et al., 2001; Tost et al., 2007; Schumann and Huntrieser, 2007), and different parameterizations simulated opposite trends over the same period (Schultz et al., 2007, REanalysis of the TROpospheric chemical composition over the past 40 years (RETRO). A long-term global modeling study of tropospheric chemistry. Final Report, Tech. rep., Max Planck Institute for Meteorology, Hamburg, Germany, 2007).

Page 22562, line 14-16: Similar results for OH were also found by Pozzoli et al. 2011(Re-analysis of tropospheric sulfate aerosol and ozone for the period 1980–2005 using the aerosol-chemistry-climate model ECHAM5-HAMMOZ, Atmos. Chem. Phys., 11, 9563-9594, 2011).

Page 22563, line 12: " water vapor increases throughout the period, but flattens . . . " or ".. is increasing . . . but flattening"

Page 22564, line 2: "SO2 emissions reached their maximum".

Page 22564, line 9: "Of the total increase in sulphate burden, 36 % of the increase occurred prior to 1950, . . .", maybe better "36% of the total increase in sulphate burden occurred before 1950, . . . ".

Page 22565, line 5-8: Similar results were also found by Pozzoli et al 2011. Figure 13. Increasing oxidation due to southward shift of the emissions. Despite total sulfur emissions decrease, the burden is almost unchanged between a simulation with

varying and fixed anthropogenic emissions (but including inter annual variability due to meteorology and natural emissions) for the period 1980 and 2005.

Page 22567, line8: I cannot find also in Section 2.2 a reference for the constant biogenic emissions. I suggest to add the references for natural emissions in Section 2.2 and how they compare with other studies.

Page 22568, line 11: can be summarized in 1-2 sentences the main conclusions from Hoyle 2009 about these differences?

Page 22574, line 18: "the model overestimates . . ."

Page 22579, line 9: typo ".. in the in the downward. . .."

Page 22584, line 28-29, Page 22585, line 1-4: On this regard, effect of meteorology on chemical composition of the troposphere, the authors may write 1-2 sentences on what found by previous studies on inter annual variability due to natural emissions and meteorology, for example the recent study of Hess and Mahowald (2009, ACP).

Page 22585, live 23: ".. of what are currently believed to be the main anthropogenic components. "

Figures:

Figures 2 and 9, maybe is better to say ". . . between 2000 and 1950 . . ." as the shown fields are 2000-1950.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 22545, 2011.